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动物分类学报

中国内蒙古道虎沟中侏罗世蚊蝎蛉科（昆虫纲，长翅目）昆虫化石

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摘 要 描述蚊蝎蛉科1新属和3新种：新属 *Decoribittacus* gen. nov.，新种美脉华美蚊蝎蛉 *Decoribittacus euneurus* sp. nov.，斑点华美蚊蝎蛉 *Decoribittacus stictus* sp. nov. 和长翼卡拉蚊蝎蛉 *Karattacus longia-latus* sp. nov.。同时修订了卡拉蚊蝎蛉属 *Karattaus* 的属征。所有的化石标本都来自内蒙古宁城县道虎沟中侏罗世九龙山组地层，模式标本现在保存于首都师范大学生命科学学院。

关键词 长翅目，蚊蝎蛉科，新属，新种，道虎沟，中侏罗世.
中图分类号 Q915，819.7

蚊蝎蛉科 Bittacidae 是长翅目 Mecoptera 中的1个大科，迄今为止全世界共发现270个现生种（Krzemiński，2007），主要生活在温带和热带。特征为翅细长，足极长，为捕捉式，末端具有1爪，第5跗节可以折叠到第4跗节上。迄今为止全世界已记录化石蚊蝎蛉25属（Krzemiński，2007；Novokshonov，1997；Petrulevičius et al.，2007；Li et al.，2008），其中大部分发现于中侏罗世（Novokshonov，2002）。中国已发现化石属4属：*Liaobittacus* Ren，1994（海房沟组），*Megabittacus* Ren，1997（义县组），*Sibirobittacus* Sukatsheva，1990（义县组）和 *Mongolbittacus* Petrulevičius et al.，2007（九龙山组）。

本文化石的鉴定和初步描绘主要借助于 Leica MZ 12.5 显微镜和绘图仪辅助完成，部分线条图借助于 Adobe CorelDraw 12 和 Adobe Photoshope CS 3 绘图软件完成。所有的化石标本保存于首都师范大学生命科学学院昆虫演化与环境变迁重点实验室。

长翅目 Mecoptera Packard，1886

蚊蝎蛉科 Bittacidae Handlirsch，1906

科征 翅基部通常非常窄，顶部加宽。翅痣一般很发达。Rs 脉和 M 脉一般为4分支，少数属的 Rs 脉为3分支或者 M 脉为5分支，CuA 脉和 M 脉在基部有短距离的融合。足末端具1爪。触角一般短于前翅。

该科化石属的分布：阿根廷，俄罗斯，美国，欧洲，蒙古，英格兰，中国，中亚；早侏罗世—早渐新世。

华美蚊蝎蛉属，新属 *Decoribittacus* gen. nov.

模式种：*Decoribittacus euneurus* gen. et sp. nov.

鉴别特征 翅细长，基部窄，从基部向顶部逐渐加宽，顶角尖形。前翅 Sc 脉极长，伸达翅痣区域或者略接近翅痣。在 Sc 脉和 R_1 脉之间有1条横脉（Scv）。R_1 脉简单，不分支，延伸进入翅痣中，端部微弯；R_1 脉和 R_{2+3} 脉之间有1条翅痣横脉（Pcv）和1条位于 Pcv 之前的横脉；Rs 脉4分支，分支位于 M 脉分支之前。M 脉4分支，M_{3+4} 在'Kreuz der Bittaciden'的横脉 r_{4+5}-m_{1+2} 之前分支；M_4 脉和 CuA 脉之间有两条横脉。1A 脉与翅边缘的交点超过 M 脉分支点。

比较 从翅脉来看，新属与来自哈萨克斯坦的 *Preanabittacus* Novokshonov，1993 相似，但是新属与它的主要区别在于 Sc 脉极长，伸达翅痣区域，1条 Pcv，M_4 脉与 CuA 脉之间有两条横脉，1A 脉长，端部超过 M 脉分支点。

迄今为止，中国一共发现蚊蝎蛉科5属，1现生属（蚊蝎蛉属 *Bittacus* Latreille，1805）和4化石属（*Liaobittacus*，*Megabittacus*，*Sibirobittacus*，*Mongolbittacus*），新属区别于他们的主要特征是 Sc 脉延伸到翅痣区域，1条 Pcv，M_4 脉与 CuA 脉之间有两条横脉。同时新属区别于其他的已知属的几个特征是：Sc 脉极长，Rs 脉4分支，Pcv 1条，M 脉4分支，M_4 脉和 CuA 脉之间有两条横脉，1A 脉长，端部超过了 M 脉的分支点。因此建立了1个新属华美蚊蝎蛉属 *Decoribittacus*。

词源：*Decoribittacus* 源于拉丁词 decor-（华美）和

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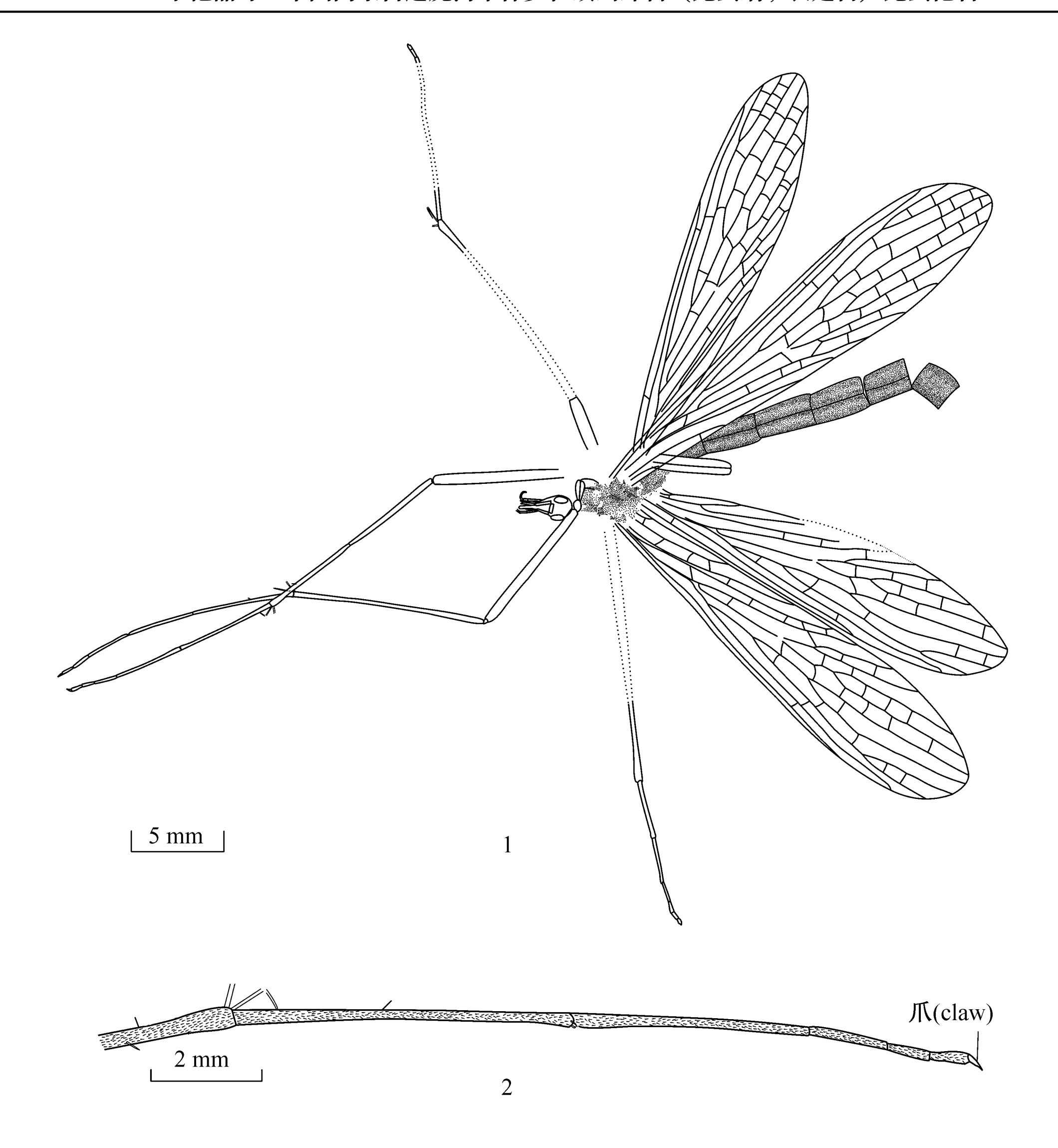


图 1～2 美脉华美蚊蝎蛉, 新种 *Decoribittacus euneurus* sp. nov., 正模(holotype) CNU-MEC-NN2007004-1
1. 虫体(body) 2. 前足跗节(fore tarsus)

Bittacus(蚊蝎蛉科的模式属)的联合。

美脉华美蚊蝎蛉, 新种 *Decoribittacus euneurus* sp. nov. (图 1～5, 9～10)

体大型, 长26 mm, 标本展现了整个虫体的背面, 4 个翅完全展开, 翅脉大部分可见。

喙细长, 复眼突出, 触角缺失。胸部保存不完整, 因此结构不可见。足细长, 其上布满不规则细毛, 前足胫节长于股节, 跗节 5 节, 末端具有 1 爪。

翅细长, 前翅长29 mm, 宽6.5 mm。从 Scv 与 Sc 的交点到 Sc 的端点之间的长度约为 Scv 长度的 9 倍。在 M 的分支处存在明斑。R_{4+5}分支点位于 M_{1+2} 分支点之前; R_2 和 R_3 之间有两条横脉, R_3 与 R_4 之间至少存在 3 条横脉, R_4 和 R_5 之间有 5 条横脉, R_5 和 M_1 之间有 6 条横脉, M_1 和 M_2 之间至少存在 3 条横脉, M_2 和 M_3 之间有 3 条横脉, M_3 和 M_4 之间有 2 条横脉。CuA 脉和 M 脉在翅基部有小段距离的融合, CuA 脉和 CuP 脉几乎平行, 它们之间有 4 条横脉。1A 脉和 2A 脉简单, 二者之间有 3 条横脉, 2A 脉长, 略微超过 R 脉的第 1 分支点, 3A 脉存在, 与 2A 脉之间由 1 条横脉连接。每条横脉上都有深褐色的翅斑。后翅长26.5 mm, 宽6 mm, 后翅除了 Sc 脉没有延伸到翅痣区域以及 1A 脉和 2A 脉在基部有融合外, 其它的特征与前翅的一致。

腹部圆筒状, 可见 6 节, 生殖器没有保存。

正模, 对板, 编号: 正板 CNU-MEC-NN2007004-1, 负板 CNU-M-NN2007004-2, 1 块保存完整的化石标本。副模, 编号: CNU-MEC-NN2007005, 1 块保存稍显粗糙的化石标本。

产地及地层: 内蒙古宁城县, 中侏罗世九龙山组。

词源: *euneurus* 为拉丁词, 美脉的。

斑点华美蚊蝎蛉，新种 Decoribittacus stictus sp. nov. (图 6，11～12)

前翅保存完整，后翅保存不完整，身体没有保存。前翅长 25 mm，**宽** 5.5 mm。**翅细长，基部窄，顶角圆形。**Sc **非常长，靠近翅痣，但是没有进入翅痣区域；从** Scv **与** Sc **的交点到** Sc **的端点之间的长度大约是** Scv **长度的** 4 **倍。在** M **的分支点存在明斑。**R_{3+4}**分支点位于**M_{1+2}**分支点之前。**R_2 **和** R_3 **之间有** 2 **条横脉，**R_3 **与** R_4 **之间至少存在** 2 **条横脉，**R_4 **和** R_5 **之间有** 4 **条横脉，**R_5 **和** M_1 **之间有** 5 **条横脉，**M_1 **和** M_2 **之间存在** 4 **条横脉，**M_2 **和** M_3 **之间至少有** 2 **条横脉，**M_3 **和** M_4 **之间有** 3 **条横脉。**CuA **脉和** M **脉在翅基部有小段距离的融合，**CuA **脉和** CuP **脉几乎平行，它们之间有** 3 **条横脉。**1A **脉和** 2A **脉简单，二者之间有** 2 **条横脉，**3A **脉没有保存。每条横脉上都有深褐色的翅斑。**

比较 **新种的** Sc **脉没有延伸到翅痣中，**1A **和** 2A **之间有** 2 **条横脉，**CuA **脉和** CuP **脉之间有** 3 **条横脉。而美脉华美蚊蝎蛉的** Sc **脉延伸到翅痣区域，长于新种，**1A **脉和** 2A **脉之间有** 3 **条横脉，**CuA **脉和** CuP **脉之间有** 4 **条横脉。**

正模，编号：正板 CNU-MEC-NN2007006-1，**负板** CNU-MEC-NN2007006-2，1 **块保存稍显粗糙的化石标本。**

产地及地层：内蒙古宁城县，中侏罗世九龙山组。

词源：stictus **为拉丁文，译为斑点的。**

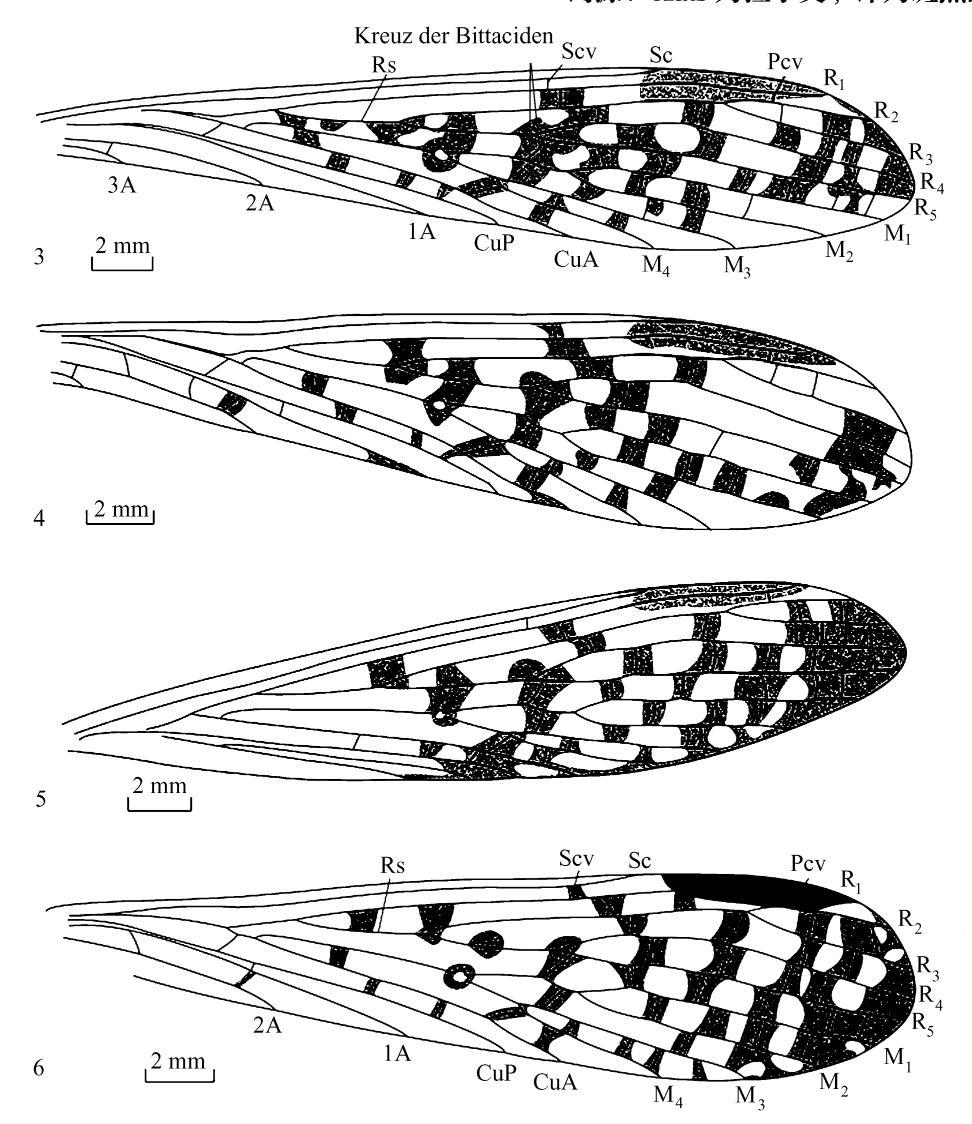


图 3～5 **美脉华美蚊蝎蛉，新种** Decoribittacus euneurus sp. nov.，**正模**（holotype）CNU-MEC-NN2007004-1
3. **右前翅**（right forewing）4. **左前翅**（left forewing）5. **右后翅**（right hindwing）

图 6 **斑点华美蚊蝎蛉，新种** Decoribittacus stictus sp. nov.，**正模**（holotype）CNU-MEC-NN2007006-1，**前翅**（forewing）

卡拉蚊蝎蛉属 Karattacus Novokshonovo, **1997**

Novokshonov, 1997. Paleontological Journal, 1 (3): 65-71.

模式种　妙卡拉蚊蝎蛉 Karattacus persibus Novokshonov, 1997

修订鉴别特征　**翅的后缘有宽的凸起。**Sc **端点与** R_{4+5}**的分支点相平或略微超过其分支点；在** Sc **和** R_1 **之间有** 1 **条横脉**（Scv）。R_1 **延伸进入翅痣中，并且在翅痣基部分出** 1 **条小的斜的分支与翅前缘相交，小分支以后** R_1 **弯曲成勺型；在** R_1 **和** R_{2+3}**之间，翅痣横脉**（Pcv）**两条；翅痣之前还有横脉** 1 **条。**Rs 4 **分支，分支点几乎与** M **脉的分支点水平。因为** M_4 **分成** M_{4a}**和** M_{4b} 2 **个分支，所以** M_5 **分支。**'Kreuz der Bittaciden' **存在。**2A **长，与翅后缘之间有** 3 **条横脉。**

长翼卡拉蚊蝎蛉，新种 Karattacus longialatus sp. nov.（图 7～8，13）

体型较大，长20 mm。**标本展现了虫体的侧面，**4 **翅基本展开，但是只有** 2 **前翅保存完整，右后翅只有部分可见。翅细长，前翅长于身体的长度，长** 23 mm，**宽**5.5 mm。Sc **长，超过** R_{4+5}**的分支。从** Scv **与** Sc **的交点到** Sc **的端点之间的长度约为** Scv **长度的** 1.5 **倍。**R_{4+5} **分支点位于** M_{1+2} **分支点之后的。**R_2 **和** R_3 **之间有** 1 **条横脉，**R_3 **与** R_4 **之间** 2 **条横脉，**R_4 **和** R_5 **之间有** 3 **条横脉，**R_5 **和** M_1 **之间有** 3 **条横脉，**M_1 **和** M_2 **之间至少存在** 2 **条横脉，**M_2 **和** M_3 **之间有** 2 **条横脉，**M_3 **和** M_{4a}**之间有** 2 **条横脉，**M_{4a}**和** M_{4b}**之间有** 1 **条横脉。**CuA **脉和** M **脉在翅基部有小段距离的融合，**CuA **脉和** CuP **脉几乎平行，它们之间有** 4 **条横脉。**1A **脉和** 2A **脉简单，二者之间有两条横脉，**

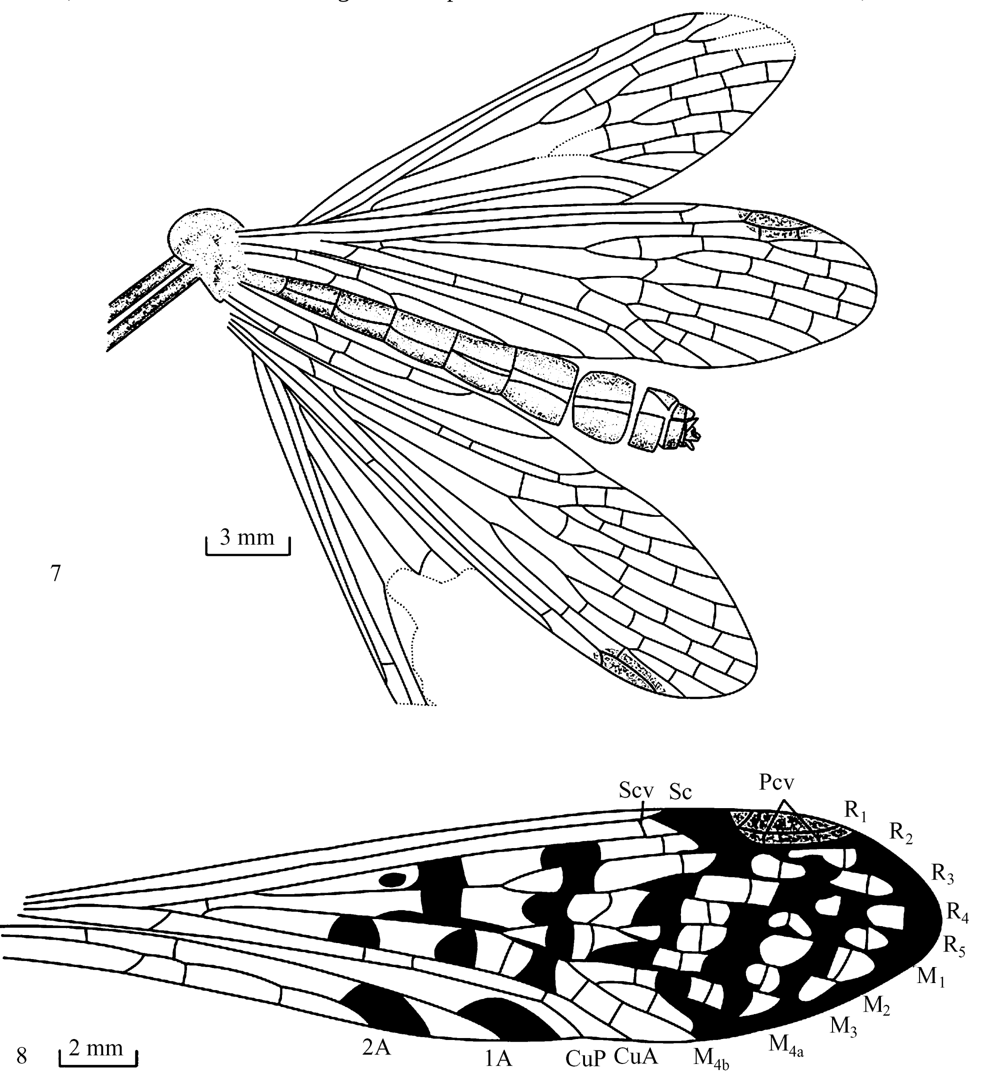


图7～8　**长翼卡拉蚊蝎蛉，新种** Karattacus longialatus sp. nov.，**正模，雌性**（holotype, female）CNU-MEC-NN2007007

7. **虫体**（body）8. **左前翅**（left forewing）

1A 脉长，超过 M 脉的分支点，2A 脉长，与翅后缘之间有 3 条横脉。后翅除了 1A 脉和 2A 脉在基部有融合外，其它翅脉的特征与前翅的一致。

腹部是楔形，前 9 节明显，第 10 节与第 9 节愈合，生殖节可见。

正模，编号：CNU-MEC-NN2007007，1 块完整的化石标本。

产地及地层：内蒙古宁城县，中侏罗世九龙

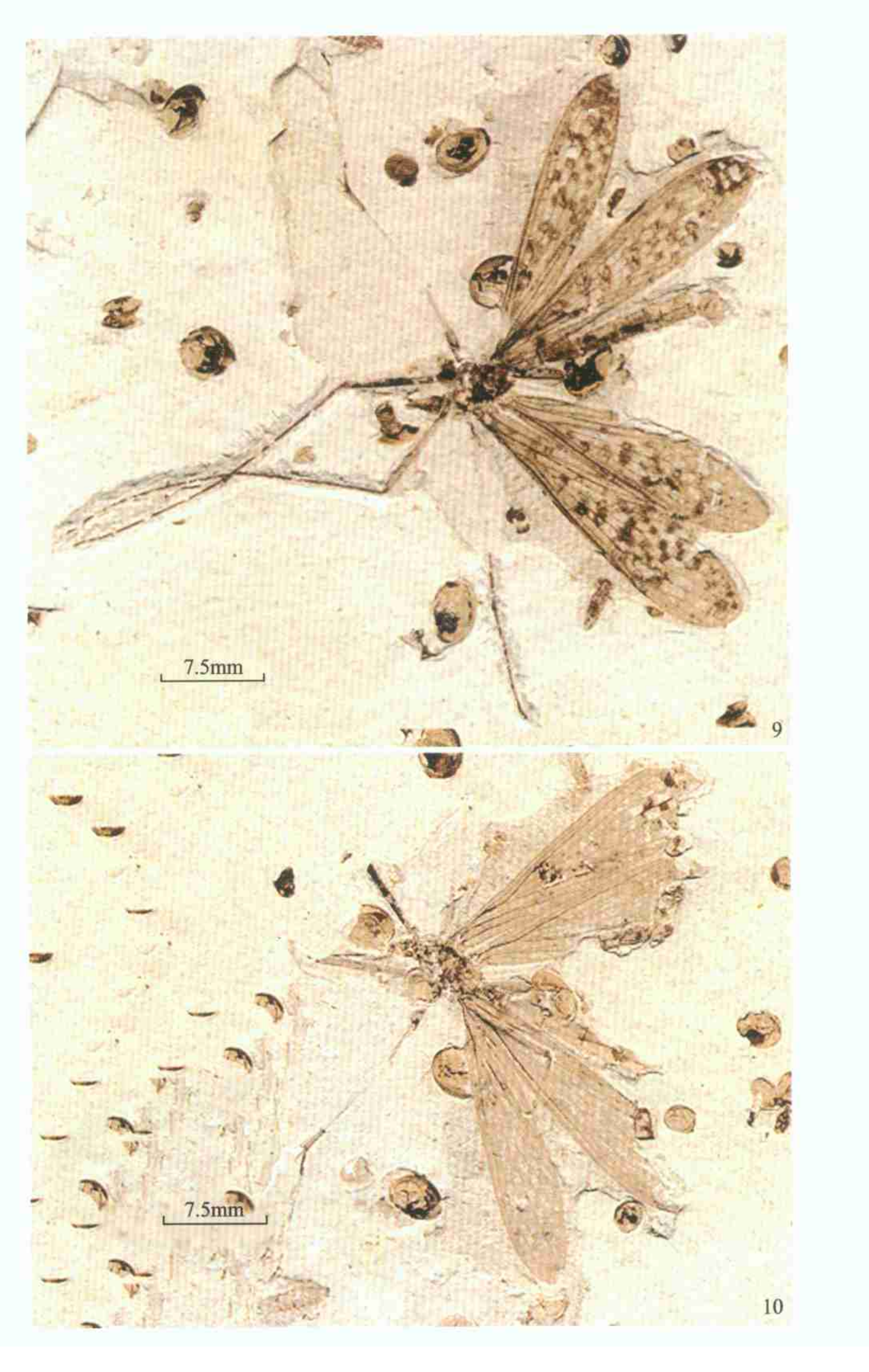


图 9～10 美脉华美蚊蝎蛉，新种 *Decoribittacus euneurus* sp. nov.，正模（holotype）
9. 正板（positive side） CNU-MEC-NN2007004-1 10. 负板（negative side） CNU-MEC-NN2007004-2

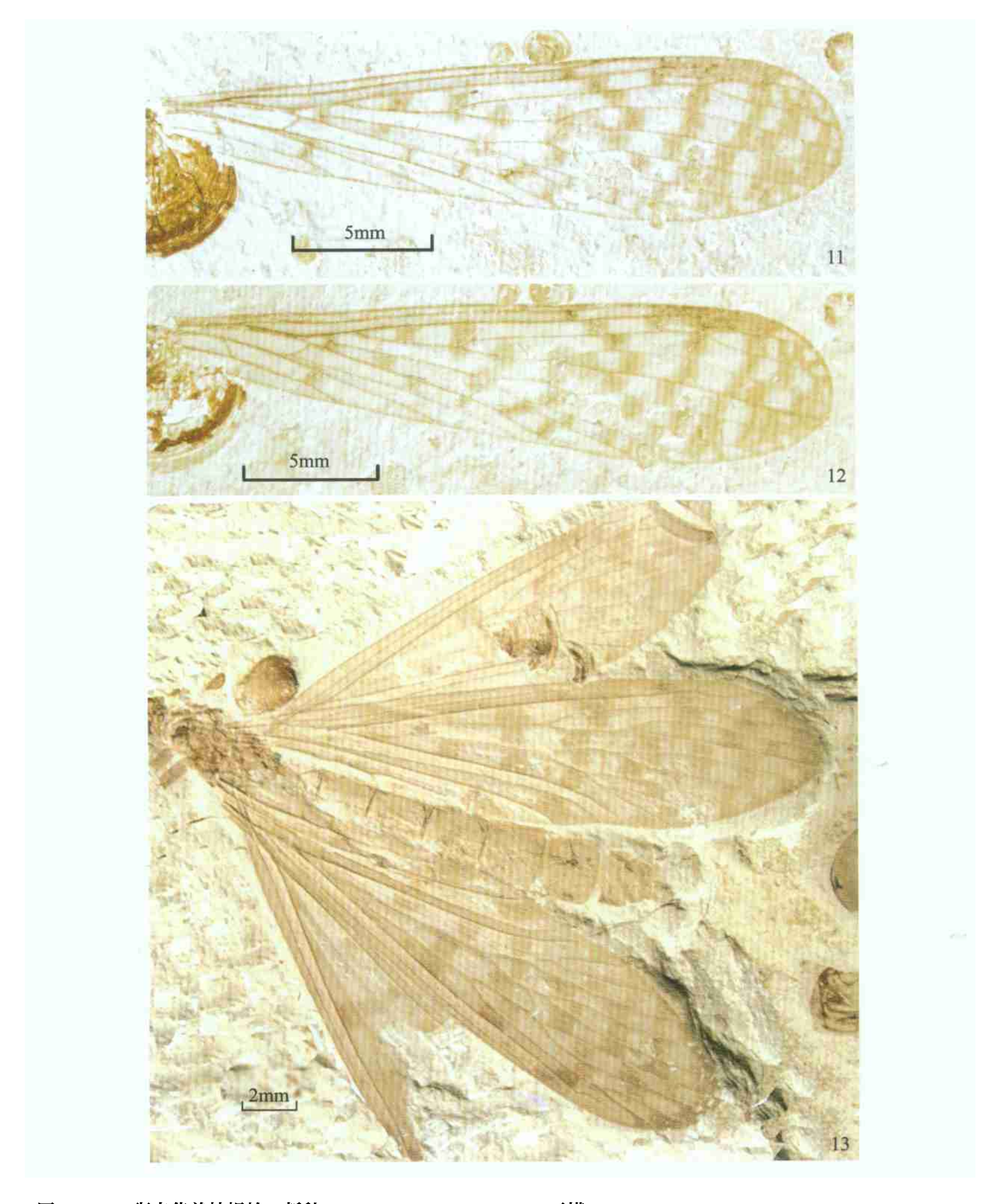


图 11～12 **斑点华美蚊蝎蛉，新种** *Decoribittacus stictus* sp. nov.，**正模**（holotype）

11. **正板**（positive side） CNU-MEC-NN2007006-1 12. **负板**（negative side） CNU-MEC-NN2007006-2

图 13 **长翼卡拉蚊蝎蛉，新种** *Karattacus longialatus* sp. nov.，**正模，雌性**（holotype, female） CNU-MEC-NN2007007

山组。

比较 新种与妙卡拉蚊蝎蛉 *Karattacus persibus* 的区别在于以下几个特征：Sc 脉长，超过 R_{4+5} 的分支点，R_{4+5} 的分支点位于 M_{1+2} 分支点之后，M_{4a} 和 M_{4b} 之间有 1 条横脉，1A 和 2A 之间有两条横脉。

词源：*longialatus* 为拉丁词，译为长翼的。

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MIDDLE JURASSIC BITTACIDAE (INSECTA, MECOPTERA) FROM DAOHUGOU, INNER MONGOLIA, CHINA

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Abstract One new genus and three new species, *Decoribittacus euneurus* gen. et sp. nov., *Decoribittacus stictus* gen. et sp. and *Karattacus longialatus* sp. nov. are described. All specimens are deposited in the Key Lab of Insect Evolution & Environmental Changes, College of Life Sciences, Capital Normal University, Beijing, China.

Decoribittacus gen. nov.

Type species. *Decoribittacus euneurus* gen. et sp. nov.

Diagnosis. Wing long and lender, its basal part narrow; Sc very long, its end enter into pterostigma or close with pterostigma. one subcostal cross-vein (Scv) between Sc and R_1; vein R_1 runs through pterostigma, it weakly and smoothly arched before apex, lacking sharp bend; one pterostigmal cross-veins (Pcv); vein R_1 joined to R_{2+3} by one cross-vein before pterostigma; vein Rs four branches, dividing before the fork of M; vein M four branches, the fork of M_{3+4} before posterior part of 'Kreuz der Bittaciden' (r_{4+5}-m_{1+2} and m_{1+2}-m_3 cross-veins); two cross-veins between M_4 and CuA; vein 1A reaching margin of wing slightly beyond the first fork of M.

Comparison. On the basis of venation, the new genus shows close similarity with fossil genus *Preanabittacus* Novokshonov 1993 from kasachstan. The new genus differs from it by Sc long, extending into pterostigma, one Pcv, two cross-veins between M_4 and CuA, vein 1A terminating beyond the first fork of M.

At present, one living genus (*Bittacus* Latreille 1805) and four fossil genera (*Liaobittacus* Ren, *Megabittacus* Ren, *Sibirobittacus* Sukatsheva and *Mongolbittacus* Petrulevičius et al., 2007, Li et al., 2008) have recorded in China. The new genus differs from them in Sc ending into Pterostigma, one Pcv, two cross-veins between M_4 and CuA. Furthermore the new genus can be distinguished from other currently known genera by a combination of the following characters: Sc very long; Rs divided four branches; one Pcv; M divided into M_{1+2} and M_{3+4}, M_{3+4} dividing before posterior part of 'Kreuz der Bittaciden; two cross-veins between M4 and CuA; 1A terminating beyond the first fork of M. Therefore, it is reasonable to erect the new genus *Decoribittacus*.

Etymology. The generic name is derived from the Latin word decor- (gaudiness) and *Bittacus* (a recent genus of Bittacidae).

Decoribittacus euneurus sp. nov. (Figs. 1-5, 9-10)

Description. Bode long 26 mm. The specimen shows a dorsal view of the whole insect. Four wings are unfolded.

Rostrum slender and long. Compound eyes is large and protruding at anterior of head. Antennae missing. Thorax is not preserved, but fore legs and middle legs are preserved, especially fore legs are perfectly preserved. They long and lender with a single tarsal claw, their tarsi with five tarsomeres; surface of all legs densely covered with short setae.

Wing narrow basally. forewing long 29 mm, wide 6.5 mm. Sc very long, extending into pterostigma; Scv at about nine times its length before end of Sc in forewing. Conspicuous thyridium at the first fork of M. M_{1+2} dividing far beyond the fork of R_{4+5}; two cross-veins between R_2 and R_3; three cross-veins between R_3 and R_4 at least; five cross-veins between R_4 and R_5; six cross-veins between R_5 and M_1; three cross-veins

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between M_1 and M_2 at least; three cross-veins between M_2 and M_3; two cross-veins between M_3 and M_4. CuA and CuP almost parallel, four cross-veins between them. 1A joined to 2A by three cross-veins; vein 2A ending slightly beyond the origin of Rs; vein 3A present, one cross-vein connect it with 2A. Hindwings seem to be identical with that of the forewings, except in the apparent fusion of 1A and CuP, Sc not extending into pterostigma.

Abdomen is partially preserved, six visible segments in dorsal view. Genital segment is not preserved.

Etymology. *Euneurus* from Latin, means beautiful venation.

Holotype. A well preserved fossil specimen. Registration No: CNU-MEC-NN2007004-1 and CNU-MEC-NN2007004-2, positive and negative. Paratype. Registration No: CNU- MEC- NN2007005.

Locality and horizon. Daohugou Village, Shantou Township; Ningcheng County, Inner Mongolia, China; Jiulongshan Formation, Middle Jurassic.

Decoribittacus stictus sp. nov. (Figs. 6, 11-12)

Description. Only one forewing is preserved, wing narrow basally, long 29 mm, wide 6.5 mm. Sc very long, not extending into pterostigma and terminating before it; sc-r at about four times its length before end of Sc. Conspicuous thyridium at the first fork of M; M_{1+2} dividing far beyond the fork of R_{4+5}; two cross-veins between R_2 and R_3; two cross-veins between R_3 and R_4 at least; four cross-veins between R_4 and R_5; five cross-veins between R_5 and M_1; four cross-veins between M_1 and M_2; two cross-veins between M_2 and M_3 at least; three cross-veins between M_3 and M_4. CuA and CuP almost parallel, three cross-veins between them. 1A joined to 2A by two cross-veins; vein 2A ending slightly beyond the origin of Rs.

Comparision. The new species differs from *D. euneurus* by the following characters: Sc terminating before pterostimag but not extending into it, two cross-veins between 1A and 2A, CuA joining CuP by three cross-veins.

Etymology. The species is named stictus after the presence of many maculae on wings.

Holotype. A specimen preserved one forewing. Registration Nos. CNU-MEC-NN2007006-1 and CNU-MEC-NN2007006-2, positive and negative.

Locality and horizon. Daohugou Village, Shantou Township; Ningcheng County, Inner Mongolia, China; Jiulongshan Formation, Middle Jurassic.

Karattacus Novokshonov, **1997**

Type species. *Karattacus persibus* Novokshonov, 1997

Revised diagnosis. Wing with broadly convex posterior margin. Sc long, extending level of the fork of R_{4+5} or beyond it; one cross-vein (Scv) between Sc and R_1. vein R_1, with a short single branch, running through pterostigma, and it is distally scoop-shaped; one pterostigmal cross-vein (Pcv); vein R_1 joining to R_{2+3} by one cross-vein before pterostigma; vein Rs four branches, dividing about level of the fork of M; vein M five branches, M_4 dividing into M4a and M4b. ‘Kreuz der Bittaciden’ present; two cross-veins between M_4 and CuA; and vein 1A reaching margin of wing about level of first fork of Rs, 2A long, joining to wing margin by three cross-veins.

Karattacus longialatus sp. nov. (Figs. 7-8, 13)

Description. Body long 20 mm. The specimen shows a lateral view. Four wings are unfolded, but only two forewings are well preserved.

Wing narrow basally; forewing long 23 mm, wide 5.5 mm. Sc long, extending slightly beyond the fork of R_{4+5}; sc-r at about 1.5 times its length before end of Sc in forewing. R_{4+5} dividing far beyond the fork of M_{1+2}, one cross-vein between R_2 and R_3; two cross-veins between R_3 and R_4; three cross-veins between R_4 and R_5; three cross-veins between R_5 and M_1; two cross-veins between M_1 and M_2 at least; two cross-veins between M_2 and M_3; two cross-veins between M_3 and M_4. CuA and CuP almost parallel, four cross-veins between them. 1A joined to 2A by two cross-veins; vein 2A ending slightly beyond the origin of Rs. Hindwings seem to be identical with that of the forewings, except in the apparent fusion of 1A and CuP.

Abdomen is perfectly preserved, ten visible segments in lateral view, Genital segment visible.

Etymology. *Longialatus* from Latin, means long wing.

Holotype. A perfectly preserved fossil specimen. Registration No. CNU-MEC-NN2007007.

Locality and horizon. Daohugou Village, Shantou Township; Ningcheng County, Inner Mongolia, China; Jiulongshan Formation, Middle Jurassic.

Comparision. The new species differs from *K. persibus* by the following characters: Sc extending beyond R_{4+5}, the fork of R_{4+5} before the fork of M_{1+2}, two cross-veins between 1A and 2A.

Key words Mecoptera, Bittacidae, new genus, new species, Daohugou, Middle Jurassic.